Real-time GPS Signal Simulator

Project Introduction

With a minimal FTE investment and no additional procurement funds, the development of a low fidelity orbital GPS Signal simulator would is possible.

This IRAD leverages existing Navigator software, MATLAB simulation tools, Goddard Enhanced Onboard Navigation System (GEONS), and TDRSS Waveform and Noise Generator (TWANG). A small amount of work is required to integrate these existing products together to develop a GPS signal simulator.

The existing GEONS API interface will be used to provide the following information about the various GPS transmitting satellites: GPS satellite signals available, signal power estimates, signal delays, and signal frequencies.

An existing low-fidelity data bit generator will be leveraged that ingests GPS ephemeris/almanac data and produces the data bit stream that is generated by the GPS satellites. The software for the data bit generator is to be updated to conform more closely to the GPS data bit structure.
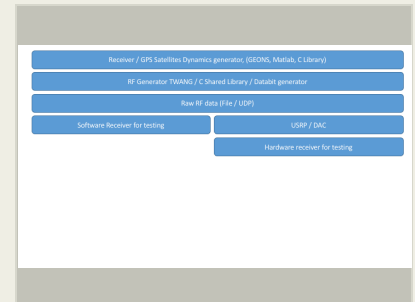
The GPS Satellite's signal information (power, Doppler, and delay) and raw data bit message would be fed into either TWANG, or part of Navigator's software would be repurposed for this application. Raw RF data would be output into a file, or onto a TCP socket. The recorded raw RF data would be replayed through our existing software receiver for initial testing.

Existing Universal Software Radio Peripherals (USRPs) in the lab would transmit the raw RF data to one of the Formation Flying Test Bed's (FFTB) GPS receivers for testing, or into a separate USRP and then into the software receiver for hardware testing.

Anticipated Benefits

This would provide the following benefits:

- Several labs across center would have access to a low-cost orbital, GPS constellation signal simulator.
- Projects using a GPS receiver would be able to use this GPS simulator at a very low cost of $3K compared to $30K for a playback simulator. This would enable testing of satellite formations at low cost.
- Possible additional licensing opportunities for GEONS and Navigator product lines.
- Demo examples of using GEONS and TWANG.
- Ability to quickly generate custom GPS signals for future GPS receiver research and development.

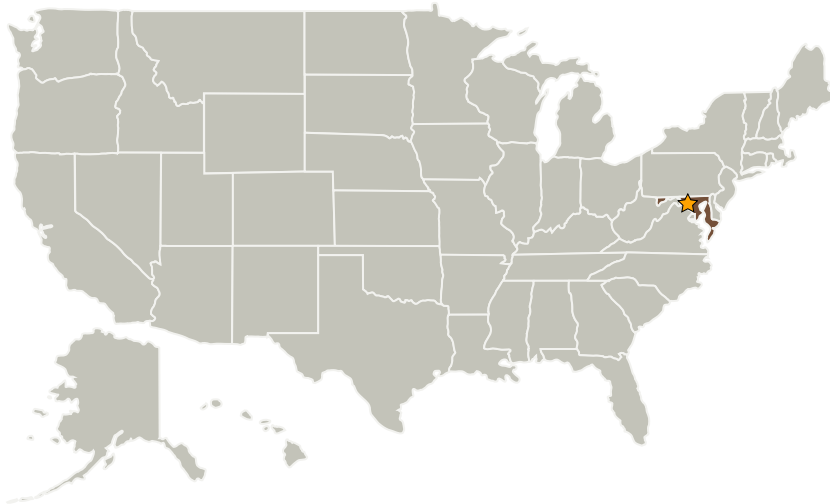GPS Signal Generator Diagram

Table of Contents

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
⭐Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Project Transitions

▶ **October 2016:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Jason W Mitchell
Timothy D Beach

Principal Investigator:

Samuel R Price

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  └ TX11.4 Information Processing
    └ TX11.4.2 Intelligent Data Understanding

TechPort

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For more information and an accessible alternative, please visit:
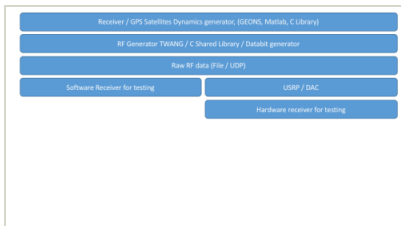https://techport.nasa.gov/view/90782

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✔ **September 2017:** Closed out

Closeout Summary: The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services.Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry.The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies.If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. http://techport.nasa.gov/help

Images

GPS Overview image
GPS Signal Generator Diagram
(https://techport.nasa.gov/image/26359)

Project Website:

http://aetd.gsfc.nasa.gov/

Target Destination
Foundational Knowledge